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How To Tell Engelmann From Blue Spruce in the Southwest

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BLUE SPRUCE—left, bark of mature tree; center, overmature tree; right, overmature tree with ridgy bark and epicormic twigs.

ENGELMANN SPRUCE— bark of mature (left) and overmature trees.



February 1977

How To Tell Engelmann

From

Blue Spruce in the Southwest [1/22/77]

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Abstract

The genetic and ecological distinctness of Southwestern spruces, and the importance of correct identification, are reviewed briefly. Photos show how to distinguish them by crown shape, branch angle, bark and foliage. (Either species may be blue.) The criteria are suited to quick on-the-job use by compartment examiners and timber markers. After brief use in the field, the characters become mental pictures and the guide is no longer needed.

About the covers:

Front: *A group of young mixed conifers, with a blue-colored Engelmann spruce on the left and a green-colored blue spruce on the right.*

Inside: *Differences in the bark of older trees are shown on the inside front cover. Differences in the bark of younger trees are shown on the inside back cover.*

Back: *Differences in branching and in foliage color of young spruce.*

How to Tell Engelmann From Blue Spruce in the Southwest

Engelmann spruce³ and blue spruce are often found together in Southwestern mixed conifer stands. While some foresters and biologists tell them apart readily and reliably, many cannot since either species may be blue. Recognizing these spruces is particularly a problem for people who are new to forests where the two occur together, but many old hands have trouble too.

The problem is more than academic. Engelmann spruce (ESp) and blue spruce (BSp) differ ecologically in some important respects. So far as summer temperatures are concerned, they occur together only in the warmer third of the ESp habitat spectrum, which is the cooler half of the BSp spectrum. BSp is better adapted to drought and high temperatures, and its seedlings survive full exposure to sunlight better than ESp seedlings. BSp has become an important windbreak species on the northern plains. ESp dominates large areas at elevations well above any occurrences of BSp, and is more shade tolerant. Such differences make species recognition important in selecting trees to be left for seed in the selection and shelterwood systems, and especially for seed collection. At least one seed lot supposedly collected from ESp trees has produced seedlings that turned out to be BSp (Jones 1975). An unknown number of these BSp have been planted on high-elevation ESp sites in New Mexico where they are not likely to survive.

Forest managers have asked for a guide to quick, reliable field identification. That is the objective of this paper.

Older Guides

As Daubenmire (1972) pointed out, existing taxonomic manuals are not very useful in telling these spruces apart. These trees overlap in certain morphological characteristics, which probably accounts for reports of hybrids in nature, as by Weber (1953) and

Porter (1957), and even of "fairly extensive natural crossing" cited by Alexander (1958). A recent mass collection, chromatography, and westwide hybrid indexes suggest that, while hybrids between ESp and BSp probably do occur in nature, they are rare (Daubenmire 1972, Taylor et al. 1975). Limited efforts to cross them artificially resulted almost entirely in empty or nonviable seeds, and the few seeds that germinated produced defective seedlings (Fechner and Clark 1969). Barriers to crossing included inhibition of pollen germination, premature death of pollen tubes, failure of the female gametophyte to develop following pollination, and failure of embryos to mature in cases where the egg was successfully fertilized (Kossuth and Fechner 1973).

Taxonomic manuals for the Southwest separate the two species almost entirely by the smoothness or pubescence of twigs, cone length, the persistence of old cones, and needle sharpness (Harrington 1954, Kearney and Peebles 1960, Martin et al. 1971, McDougall 1973). ESp twigs are said to be pubescent and BSp twigs hairless. But Daubenmire (1972) found that a substantial proportion of BSp had sparsely haired twigs and some had twigs on which hair was copious. Twigs on most ESp had copious hair, but on many, hair was sparse, and some had none. More important, these criteria, while somewhat useful, are not very practical on jobs such as compartment examination and timber marking.

Harrington (1954) also mentioned that, in Colorado, mature BSp have furrowed bark. In the Southwest, old BSp often have furrowed bark, but many mature BSp do not. In an article in *Colorado Outdoors*, Fechner (1973) pointed out that the immature cones of BSp are yellow green while those of ESp are blood red.

Recently, Daubenmire (1972) found that the two species can be reliably identified using characteristics of extracted cone scales. His method is useful only for cone-bearing trees, however, and does not fill the need for quick field identification because scales must be removed undamaged from the cones. Dry cones need to be soaked, or their scales will shatter when they are extracted.

³Common and scientific names of plants mentioned are listed on page 10.

The Approach Here

Several foresters and biologists confronted with this identification problem have asked for field coaching. They were pleased to find that, when certain characters were pointed out to them in the field, they could tell the two spruces apart easily, quickly, and confidently. The characters usually can be evaluated at a glance, but are not effectively described in words. Therefore, photographs are used here as a substitute for field coaching.

First we show characters of mature trees that are useful at a considerable distance. Next are characters that are useful at a few yards. Characters that require close examination are given last. For mature trees the latter are seldom needed.

While most of the characters used here are variable within each species, overlap between the two species is limited. Where appropriate, the variation within each species has been photographed. While sometimes a character taken singly will leave you in doubt, two or more taken jointly provide confident identification.

Unfortunately we do not know how to differentiate very young spruce seedlings after the hypocotyl of BSp germinants has lost its distinctive reddish color. When they are 5 to 10 years old—usually 6 inches tall or taller—they can often be identified, at least tentatively, and 3-foot seedlings usually can be identified with confidence.

Some characters of ESp vary with elevation. In this paper we are interested only in how ESp looks at elevations where BSp also grows—elevations below about 10,000 feet in the Southwest. Those are the ESp illustrated and described here. In the Southwest you are unlikely to see BSp as high as 10,000 feet, and ESp will rarely be seen as low as 8,000 feet.

Finally, this guide is based primarily on 15 years of observations in the White Mountains of Arizona, where the pictures were taken. Limited experience in other areas suggests that it is generally valid for Arizona, New Mexico, and southern Colorado, but that farther north it is less accurate. The characters listed here are unreliable for spruce planted and irrigated where they are not native.

What to Look For

At a Distance

At a distance the general outline of a BSp crown is usually different from that of an ESp. Mature trees can often be identified at 100 yards if their tops can be seen clearly.

Mature BSp crowns are often very narrow and typically retain a pointed top into old age (fig. 1). In old spruce a narrow pointed top is an almost positive



Figure 1.—Blue spruce crowns.





In 1B, the prominent crown to the right of the two blue spruces is a Douglas-fir.



indication that it is BSp. Also, individual branches of BSp usually appear more distinct and conspicuous than branches of ESp (fig. 2). Blue spruce branches commonly stick almost straight out. This is less apparent than usual in figure 1 because the upper crowns of 1A and 1E are heavily loaded with ripening cones and hang down somewhat. The lower crowns of those two trees, especially 1E, show the more usual branching character.

The right-hand crown in 1B is Douglas-fir.

Figure 2 shows a wide range of mature ESp crown forms. All the major crowns are ESp in each picture except 2D, where crowns of several species are outlined. The prominent central crown in 2D is a middle-aged ESp.

The rather open ESp crowns in 2F are not usual in the Southwest as a whole. They are more typical of ESp in the Chiricahua and Graham Mountains where there is no BSp.

At Close Range

Up closer, clumps of epicormic twigs sprout from the trunks of many BSp (inside front cover), and sometimes are very abundant. These epicormic twigs are typically 2 to 12 inches long. They often can be seen at a distance as a bushiness on the trunk (right-hand tree in fig. 1F).

Bark differences are probably the surest and simplest way to tell these spruces apart (inside front cover). The scales of old BSp bark look hard and tend to be oriented in vertical rows or ridges. In younger, mature BSp the scales look softer but still tend to form vertical rows. Bark of mature BSp is brown, gray-brown, or gray.

On mature and overmature ESp the bark scales appear larger, looser, and much more randomly arranged. Where scales have fallen from ESp bark, the underbark is commonly purplish but may also be reddish brown. The scales themselves are gray.



Figure 2.—Engelmann spruce crowns.





In 2D, the only prominent Engelmann spruce is the center tree.



Saplings are usually easy to identify at a little distance. The branches of BSp saplings are stiff and nearly at right angles to the trunk, tending to form separate planes at the nodes. The overall impression is of bristliness (fig. 3). In fact, BSp in general gives a sense of bristliness. The branches of ESp at these elevations look less stiff, rarely form planes, and give a softer appearance (fig. 4). Usually they angle upward from the trunk and commonly droop at the ends. Figure 5 shows two ESp saplings on the left, their branching contrasting sharply with the strongly planar branching of the three BSp at center and right.

Foliage color is often useful, especially in saplings and large seedlings. At elevations where both spruces grow, the foliage of young ESp is always at least

somewhat bluish and often quite blue. But while many BSp saplings are distinctly blue colored and some are intensely bluish white, ironically many other young BSp have no bluish tinge at all. In some locales the no-blue form of BSp predominates strongly; in others the blue form may be common. If a young spruce in a mixed conifer stand is green with a brassy tinge and **has no trace of blue**, it is BSp. If it is bluish it may be either species. On the outside back cover are two blue-colored ESp (left foreground). To the right of them is one blue-colored BSp between two green-colored BSp.

Many white fir in the Southwest also have distinctly blue-white foliage, and in a moment of carelessness can be mistaken for BSp.



Figure 3.—Young blue spruce, showing bristly planar branching.



Figure 4.—Young Engelmann spruce.



Figure 5.—A group of mixed spruces. The three at center and right, with planar branching, are blue spruce. The two on the left are Engelmann spruce.



Figure 6.—Sapling twigs of Engelmann spruce (left) and blue spruce (right).

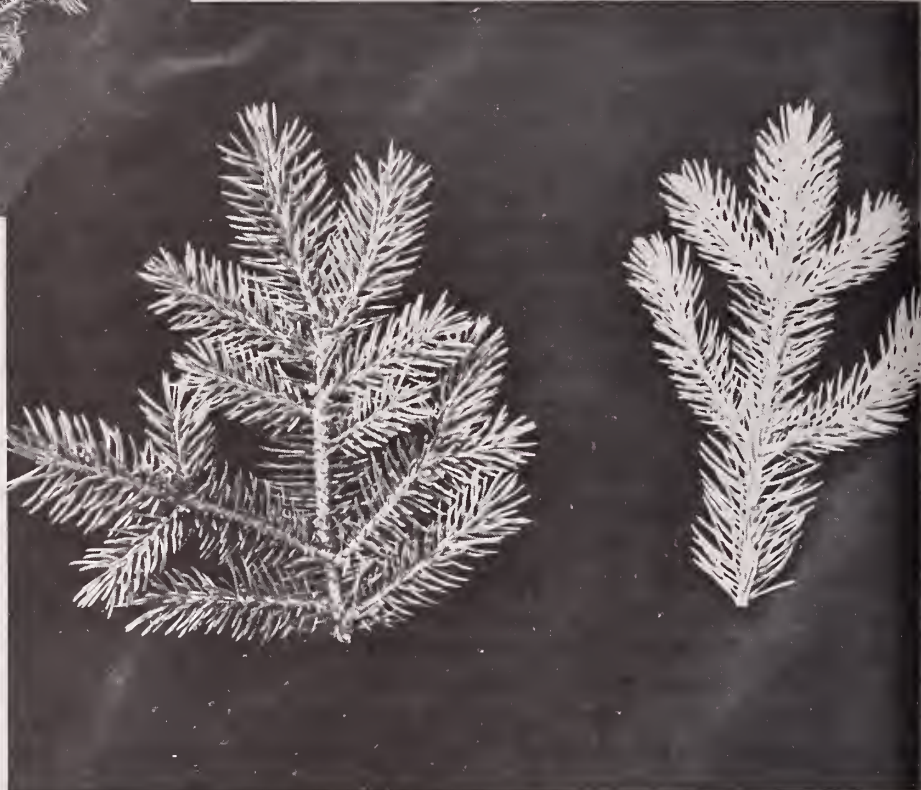


Figure 7.—Closer view of blue spruce (left) and Engelmann spruce twigs.

Up Close

Close up, the bark of saplings and small poles is consistently different between the two species (inside rear cover). Bark of young BSp is more or less flaky looking, with reddish brown scales, even where stem diameter is smaller than 2 inches. Bark on ESp of the same size is light gray and sometimes has a yellowish tinge. It may be nearly smooth or have tight fine-textured scales. These inside cover pictures also point up again the comparatively bristly look of BSp.

The twigs and foliage of the two spruces also differ close up (figs. 6 and 7). Once again the bristly look of BSp is apparent, while ESp looks softer. ESp needles lie closer to the twigs in most cases, rather than nearly at right angles as with BSp. This is the main criterion in identifying smaller seedlings (figs. 8, 9, and 10).

Twig color is sometimes suggested as a criterion for identifying saplings and large seedlings, but it

can mislead you. In either species it may be gray, tan, or yellow. BSp twigs are often orange, and in almost all cases if the twigs are orange it is BSp. But very infrequently ESp have orange twigs.

In late spring when BSp buds are just opening, associated ESp have already made considerable new shoot growth.

The aroma of needles crushed between the fingers differs between the two species, at least for some people. The difference is hard to describe. Try it and see if it works for you.

When an individual character is ambiguous, looking at several should be decisive. It is our experience that, if an individual character clearly indicates BSp, or ESp, other characters will very rarely contradict it.

As you use this guide you will run into an occasional "if" or "but" not mentioned here. We left them out purposely. They are minor, and to go into them would obscure the pointers given here without helping spruce identification. You will discover the ifs and buts for yourself and find they are no problem.



Figure 8.—Engelmann spruce seedling.



Figure 9.—Blue spruce seedling.



Figure 10.—Seedlings of blue (left) and Engelmann spruce side by side.

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Common and Scientific Names of Plants Mentioned

Engelmann spruce	<i>Picea engelmannii</i> Parry
Blue spruce	<i>Picea pungens</i> Engelm.
Douglas-fir	<i>Pseudotsuga menziesii</i> var. <i>glauca</i> (Beissn.) Franco
White fir	<i>Abies concolor</i> (Gord. & Glend.) Lindl.

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Keywords: *Picea engelmannii*, *Picea pungens*, field identification, taxonomy.



Bark of young blue spruce.

Bark of young Engelmann spruce.





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